

# Fundamentals of Protection Elastomers (SIL)

## TYPE

**What is it:** The physical molecular structure of an elastomer material defines its “type”

**Importance:** Inherent physical material properties = PERFORMANCE

## COLOR

**What is it:** Color of the elastomer core

**Importance:** If visible, aesthetics can be important; elastomer color matches to adjacent surfaces

## GAUGE

**What is it:** The gauges indicated are those offered today and are expressed in inches (mm)

**Importance:** Most projects have a predefined joint/gap due to design specifics:

- Thicker Foams: Fill larger gaps and can accommodate nonparallel surfaces.
- Thinner Foams are for smaller gaps and less expensive

## MATERIAL STIFFNESS

**What is it:** General Reference to categorize the “Softness/Hardness/Stiffness” of our materials

**Importance:** Indicative of 4 CRITICAL material properties (discussed below):

Density, Force to Compress, Compression Deflection & Hardness

## MATERIAL STIFFNESS: DENSITY

**What is it:** Measurement of Mass lb./ft<sup>3</sup> (kg/m<sup>3</sup>)

**Importance:** A relative indication of firmness & weight

**Industry Standard:** ASTM D3574 or ASTM D1667

## MATERIAL STIFFNESS: COMPRESSION DEFLECTION

**What is it:** Force to compress material 25% immediate.

Three general grades:

- Soft = 2-7 psi
- Medium = 6-14 psi
- Firm = 12-20 psi

**Importance:** This is an indication of resiliency or cushioning capability, as well as the ability to provide a seal (water/air). Softer silicones have lower force, firmer silicones have higher forces.

**Industry Standard:** ASTM D1056.

## MATERIAL STIFFNESS: HARDNESS

**What is it:** Defined as a material’s resistance to permanent indentation. A variety of spring gauge devices are used for measurements. SIL elastomer utilize Shore A to 00 scale.

**Importance:** It is an easy technique and ideal for solids. Values generated for cellular elastomers is a relative indication & not as precise as FTC/CFD.

**Industry Standard:** ASTM D2240

## STRENGTH — TENSILE STRENGTH

**What is it:** Amount of force required to stretch the core elastomer until it breaks, typically shown in units of psi (kPa)

**Importance:** Provides an understanding of the toughness &/or robustness of the core elastomer

**Industry Standard:** ASTM D3574, ASTM D412 die A

## STRENGTH — ELONGATION @ BREAK

**What is it:** Amount the core elastomer is able to stretch prior to breaking, measured as %

**Importance:** Provides an understanding of the core elastomer ability to stretch

**Industry Standard:** ASTM D3574, ASTM D412 die A

## FATIGUE RESISTANCE — COMPRESSION SET RESISTANCE

**What is it:** Amount the elastomer recovers to its original height after being compressed 50% for 24 hr period (sample conditioned under ambient conditions 70°F (21°C)).

**Importance:** Provides a reference to the elastomer’s resiliency and ability to seal. Lower value is more desirable.

**Industry Standard Test:** ASTM D3574 or ASTM D1667

## WATER SEAL — WATER ABSORPTION

**What is it:** Amount of water absorbed by the elastomer as a % change by volume when submerged at 2” depth

**Importance:** Provides an indication of its ability to water seal (cell structure may also have an influence)

**Industry Standard Test:** ASTM D1056, NTP 35, AMS 3568-b

## WATER SEAL — U-SEAL TEST

**What is it:** Laboratory simulation of a water seal of the elastomer at 2” water height

**Importance:** Simulates water seal gasket at low pressure

**Industry Standard Test:** NTP38

## WATER SEAL — INGRESS IPX7

**What is it:** Laboratory simulation of a water seal following a more severe conditions:

- 3 = 1 Meter @ 25% compression
- 2.5 = 0.6M @ 25% compression
- 2 = 0.6M @ 50% compression
- 1.5 = 0.15M @ 50% compression
- 1 = 0.15M @ 75% compression

**Importance:** Simulates water seal gasket for modest pressure. Common enclosure ratings (example battery pack assembly or electronic enclosures).

**Industry Standard Test:** IPX7 reference

## TEMPERATURE SERVICE RANGE

**What is it:** Temperature range in which the elastomer would undergo limited performance variations under load and in which thermal degradation is negligible


**Importance:** Need to ensure the elastomer performs for the expected application temperatures



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*Strong Feature	Market	IND/ELEC/AERO	IND/ELEC/AERO	IND/ELEC	IND/ELEC	IND/ELEC/AERO	IND/ELEC/AERO	IND/ELEC/AERO	IND/ELEC/AERO	IND/ELEC/AERO	IND/ELEC/AERO	IND/ELEC/AERO	IND/ELEC/AERO	IND/ELEC/AERO	IND/ELEC/AERO	IND/ELEC/AERO	IND/ELEC/AERO
		Solid			Reinforced	Sponge						Foam		Tape			
	Adhesive Type	Optional Acrylic (sol.) or silicone	Optional Acrylic (sol.) or silicone	Optional Acrylic (sol.) or silicone	Optional Acrylic (sol.) or silicone	Optional Acrylic (sol.) or silicone	Optional Acrylic (sol.) or silicone	Optional Acrylic (sol.) or silicone	Optional Acrylic (sol.) or silicone	Optional Acrylic (sol.) or silicone	Optional Acrylic (sol.) or silicone	Optional Acrylic (sol.) or silicone	Optional See SNS 512AF	Optional See SNS 520AF	Acrylic (sol.) or silicone	Acrylic (sol.) or silicone	Supported Acrylic (sol.)
Standard Liner	None	None	None	None	None	None	None	None	None	None	None	PET	PET	Paper	Paper	Paper	Paper
What	Legend	300-700 / 9030-9070	9235-9275	EC102	3320/4420/4480	R10470M	R10470F	R10480S	R10480M	R10460	R10400M	F12	F20	SNS 440A/440S	SNS 100S/200A	SNS 512AF	SNS 520AF
 <b>“Snapshot” Summary</b>		Sheets / Roll goods of general purpose	Roll goods for high performance tear resistant	Electrically conductive for managing static dissipation	Series of reinforced solid press pads for high temperature & pressure use in fabricating PCBs	Multi-purpose sponge rubber (most popular)	Firmer grade option of R10470M series	Softer, modified version of R10470M with additional compression set resistance	Modified version of R10470M with additional compression set resistance	Modified version of R10470M with flame resistance meeting UL HBF	Modified version of R10470M with flame resistance meeting more stringent UL VO	Lightest (less dense) flame resistance silicone foam	Denser version of F12 with enhanced water sealing capability	Adhesive tape versions of 9030 solid	Adhesive tape versions of R10470M (most popular)	Adhesive tape version of F12	Adhesive tape version of F20
TYPE	The physical molecular structure of an elastomer material defines its “type”	SIL	SIL	SIL	SIL	SIL	SIL	SIL	SIL	SIL	SIL	SIL	SIL	SIL	SIL	SIL	SIL
COLOR	Color of the elastomer core	Red	Gray	Black	Orange/Brown/Black	Orange-tan (optional gray or black)	Orange-tan	Red (optional black)	Brown	Dark Blue	Blue	Gray; Optional Black or White	Gray or Black	Gray	Orange-tan	Gray	Gray or Black
GAUGE	The gauges indicated are those offered today and are expressed in inches (mm)	0.031”-0.25” (0.8-6.4), product dependent	0.031”-0.125” (0.8-3.2), product dependent	0.020” (0.5) 0.032” (0.79) 0.062” (1.6) 0.094” (2.4) 0.125” (3.2)	0.063”-0.125” (1.6-3.2), product dependent	0.031” (0.8) 0.062” (1.6) 0.094” (2.4) 0.125” (3.2) 0.188” (4.8) 0.25” (6.4) 0.375” (9.5) 0.5” (12.7)	0.031” (0.8) 0.062” (1.6) 0.094” (2.4) 0.125” (3.2) 0.188” (4.8) 0.25” (6.4) 0.375” (9.5) 0.5” (12.7)	0.094”(2.4) 0.125” (3.2) 0.188” (4.8) 0.25” (6.4) 0.375” (9.5) 0.5” (12.7)	0.062” (1.6) 0.094”(2.4) 0.125” (3.2) 0.188” (4.8) 0.25” (6.4) 0.375” (9.5) 0.5” (12.7)	0.062” (1.6) 0.094”(2.4) 0.125” (3.2) 0.188” (4.8) 0.25” (6.4) 0.375” (9.5) 0.5” (12.7)	0.062” (1.6) 0.094”(2.4) 0.125” (3.2) 0.188” (4.8) 0.25” (6.4) 0.375” (9.5) 0.5” (12.7)	0.062” (1.6) 0.094”(2.4) 0.125” (3.2) 0.188” (4.8) 0.25” (6.4) 0.375” (9.5) 0.5” (12.7) 0.75” (19) 1” (25.4)	0.032” (0.8) 0.062” (1.6) 0.094” (2.4) 0.125” (3.2) 0.188” (4.8) 0.25” (6.4) 0.375” (9.5) 0.5” (12.7)	0.031” (0.8)	0.062” (1.6) 0.094”(2.4) 0.125” (3.2) 0.188” (4.8) 0.25” (6.4) 0.375” (9.5) 0.5” (12.7)	0.062” (1.6) 0.094”(2.4) 0.125” (3.2) 0.188” (4.8) 0.25” (6.4) 0.375” (9.5) 0.5” (12.7)	0.062” (1.6) 0.094”(2.4) 0.125” (3.2) 0.188” (4.8) 0.25” (6.4) 0.375” (9.5) 0.5” (12.7)
MATERIAL STIFFNESS	General Reference to categorize the “Softness/Hardness/Stiffness” of our materials	Very firm	Very firm	Very firm	Very firm	Medium	Firm	Soft	Medium	Medium	Medium	Soft	Medium	Very firm	Medium	Soft	Medium
MATERIAL STIFFNESS: DENSITY	Measurement of Mass lb./ft <sup>3</sup> (kg/m <sup>3</sup> )	Ref. 95 (1520)	Ref. 95 (1520)	Ref. 95 (1520)	Ref. 95 (1520)	29 (470)	43 (692)	21 (332)	29 (470)	29 (470)	29 (470)	12 (192)	20 (320)	Ref. 95 (1520)	29 (470)	12 (192)	20 (320)
MATERIAL STIFFNESS: COMPRESSION DEFLECTION	Force to deflect (push back) immediate when compressed to thickness of 10% to 25% of original height: 3 = > 25 psi 2.5 = 16-24 psi 2 = 7-16 psi 1 = < 6 psi	3	3	3	3	2	2.5	1	2	2	2	1	2	3	2	1	2
MATERIAL STIFFNESS: HARDNESS	Defined as a material’s resistance to permanent indentation. A variety of spring gauge devices are used for measurements. SIL elastomer utilize Shore A to 00 scale	30-70 Shore A	30-70 Shore A	60 Shore A	65 to 80 Shore A product dependent	53 Shore 00	65 Shore 00	45 Shore 00	53 Shore 00	53 Shore 00	53 Shore 00	35 Shore 00	57 Shore 00	30 Shore A	53 Shore 00	35 Shore 00	57 Shore 00
STRENGTH – TENSILE STRENGTH	Amount of force required to stretch the core elastomer until it breaks, typically shown in units of psi (kPa)	700 to 900 (4800 to 6200) product dependent	1150-1200 (7900-8300) product dependent	700 (4800)	N/A internal fabric	90 (620)	130 (900)	50 (345)	75 (515)	75 (515)	100 (690)	25 (172)	30 (207)	850 (5865)	90 (621)	NA (supported PSA)	NA (supported PSA)
STRENGTH – ELONGATION @ BREAK	Amount the core elastomer is able to stretch prior to breaking, measured as %	160% to 500% product dependent	350%-800% product dependent	200%	N/A internal fabric	150%	200%	75%	125%	125%	250%	60%	60%	500%	150%	NA (supported PSA)	NA (supported PSA)
FATIGUE RESISTANCE – COMPRESSION SET RESISTANCE	Amount the elastomer recovers to its original height after being compressed 50% for 24 hr period (sample conditioned under ambient conditions 70°F (21°C))	15-20% @ 320F (160C) product dependent	30% @ 320F (160C)	20% @ 212F (100C)	N/A	15% set when compressed 50% at 212F (100C)	15% set when compressed 50% at 212F (100C)	5% set when compressed 50% at 212F (100C)	5% set when compressed 50% at 212F (100C)	5% set when compressed 50% at 212F (100C)	10% set when compressed 50% at 212F (100C)	5% set when compressed 50% at 212F (100C)	5% set when compressed 50% at 212F (100C)	20% @ 320F	15% set when compressed 50% at 212F (100C)	5% set when compressed 50% at 212F (100C)	5% set when compressed 50% at 212F (100C)
WATER SEAL – WATER ABSORPTION	Amount of water absorbed by the elastomer as a % change by volume when submerged at 2” depth	0%	0%	0%	0%	<5%	<5%	<5%	<5%	<5%	<5%	<5%	<1%	0%	<5%	<5%	<1%
WATER SEAL – WATER – U-SEAL TEST	Laboratory simulation of a water seal of the elastomer at 2” water height	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass
WATER SEAL – INGRESS IPX7	Laboratory simulation of a water seal following a more severe conditions: 3 = 1Meter @ 25% compression 2.5 = 0.6M @ 25% compression 2 = 0.6M @ 50% compression 1.5 = 0.15M @ 50% compression 1 = 0.15M @ 75% compression	3	3	3	3	2	3	2	2	2	2	1	2.5	3	2	1	2.5
TEMPERATURE SERVICE RANGE	Temperature range in which the elastomer would undergo limited performance variations under load and in which thermal degradation is negligible	-100-500F (-73-260C)	-100-400F (-73-204C)	-100-500F (-73-260C)	350-650F (177-343C) Product dependent	-100-500F (-73-260C)	-100-500F (-73-260C)	-100-500F (-73-260C)	-100-500F (-73-260C)	-100-500F (-73-260C)	-100-500F (-73-260C)	-60-400F (-51-204C)	-60-400F (-51-204C)	-20-350F (-29-177C) or -100-500F (-73-260C) product dependent	-20-350F (-29-177C) or -100-500F (-73-260C) product dependent	-20-350F (-29-177C)	-20-350F (-29-177C)
Other Unique Attributes			High tear strength	Electrically conductive	See individual products for unique attributes	UL JMST2		UL JMLU2		UL HBF; UL JMST2	UL VO	ULVO, & others flame resistant properties; UL JMST2	ULVO, & others flame resistant properties; UL JMST2		UL JMST2	UL JMST2	